M4.08.0 Controlled Density Fill.

Controlled Density Fill (CDF) material is a flowable, self consolidating, rigid setting, low density material that can substitute for compacted gravel for backfills, fills and structural fills. There are two main categories of CDF's, excavatable and non-excavatable with a subcategory of flowable and very flowable. It shall be a mixture of portland cement, flyash (if very flowable), sand, and water designed to provide strengths within the range specified.

The categories of CDF's are:

Type 1	Very Flowable (Non-Excavatable)
Type 1E	Very Flowable (Excavatable)
Type 2	Flowable (Non-Excavatable)
Type 2E	Flowable (Excavatable)

The Very Flowable mixes (Type 1 and 1E) shall contain a minimum of 115 kilograms of Class F Fly Ash or high air (25% plus) and will be self leveling.

Excavatable mixes (Type 1E and 2E) shall be hand tool excavatable.

Type 1 mixes are intended for permanent installations such as structural fills under structures. It has very flowable characteristics needed for distances and small areas. This type of mix should not be used as a bedding material. It is used to fill small hard-to-reach areas.

Type 1E mixes are excavatable material designed to have very flowable characteristics needed for filling small or far areas that later may need to be removed.

Type 2 mixes are used in areas where size and distance do not need the very flowable characteristic. It is intended for permanent installations such as thick fills under structures.

Type 2E mixes are excavatable mixes where size and distance of the installation do not require the flowable characteristics of a Type 1E mix.

CDF is to be batched at a ready mix plant and is to used at a high or very high slump of approximately
250 millimeters to 300 millimeters. It shall be flowable, require no vibration and after it has been placed can, for Types 1E and 2E, be excavatable by hand tools and/or small machines.

The ingredients shall comply with the following:

Portland Cement	AASHTO M 85
Fly Ash	AASHTO M 295 Class F
Sand	M4.02.02
Air entraining admixtures	M4.02.05

Note 1. In lieu of the slump test, a 150 millimeter long, 75 millimeter diameter tube may be filled to the top and then slowly raised. The diameter of the resulting "pancake" may be measured and the range of the diameter shall be 230 millimeters to 360 millimeters.

Note 2. The maximum strength for structural flowable fills may be expressed in increments of
5 MPa's and will depend on the Engineer's requirements.

Note 3. High air (25% plus) may be used instead of fly ash with an adjustment in sand content.

The following Type 1E mix design is for information only, the actual mix designs submitted by the ready mix operator, in accordance with standard Department practice, must be confirmed by trial batches.

Cement	23 kilograms
Fly Ash	115 kilograms
Sand	1225 kilograms
Water	225 liters

The following Type 1 mix design is for information only, the actual mix designs submitted by the ready mix operator, in accordance with standard Department practice, must be confirmed by trial batches.

Cement	45 kilograms
Fly Ash	115 kilograms

Sand	1200 kilograms
Water	225 liters

Various types of controlled density fill must meet the requirements set forth in the table below:

Controlled Density Fill	Type 1 & 2	Type 1E & 2E
Compressive Strength @ 28 days	210 - 1030 kPa	210 - 550 kPa*
Compressive Strength @ 90 days	1380 kPa max.	700 kPa max.*
Slump	250-300 mm	250 - 300 mm

* May be changed by design engineer to fit particular job requirements.